

A Strategy to Produce Realistic, Cost-Effective Measures of Job Performance

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**A Strategy to Produce Realistic, Cost-Effective Measures of
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FOREWORD

As the Army embarks on its transformation to the future, a variety of changes will be required to align personnel systems with future goals and objectives. In April 2002, the Army Training and Leader Development Panel (ATLDP) released the results of its survey of 35,000 noncommissioned officers (NCOs). The ATLDP's recommendations included the need for regular assessment of Soldiers' technical, tactical, and leadership skills. In response to this need, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) issued a Small Business Innovation Research (SBIR) Phase I contract entitled "Cost-effective, Realistic Measures of Job Performance." The aim of the research project was to develop a methodology to produce realistic and cost-effective performance measures. The Phase I research and development efforts have laid the groundwork for the development of prototype military occupational specialty (MOS) performance measures on a realism continuum to determine the necessary realism for different job categories.

ARI's Selection and Assignment Research Unit conducts research, studies, and analyses of individual difference measures (of aptitudes, motivations, and other attributes) related to Soldiers' job performance. The primary goal is to improve the Army's selection and classification, promotion, and reassignment of enlisted soldiers and officers. The research presented in this report demonstrates how the Small Business Innovation Research (SBIR) Program can support these objectives.



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A STRATEGY TO PRODUCE REALISTIC, COST-EFFECTIVE MEASURES OF JOB PERFORMANCE

EXECUTIVE SUMMARY

Research Requirement:

For most MOS, the Army lacks objective measures to assess the ability of Soldiers to perform the technical components of their jobs. Such measures are needed to support the full range of Army enlisted human resource requirements, including recruiting, selection, training, self-development, promotion, and transition assistance for Soldiers exiting the Army. The objective of this effort was to develop a methodology to produce realistic and cost-effective measures.

Procedure:

Job Performance Systems, Inc. (JPS) and its subcontractor, the Human Resources Research Organization (HumRRO) began this effort by identifying 11 types of assessment methods having the potential for use in this effort. Included in the list were computer-based tests and simulations designed to create an engaging, virtual representation of a military occupational specialty (MOS).

Participants in a clustering workshop used this list, descriptions of MOS, and other resource materials, to identify seven groups of MOS. Common to all MOS in a group was their suitability for assessment using a specific type of assessment method(s). The seven clusters of MOS provide a structure for pursuing performance measures across the Army.

The JPS team then developed a two-phased strategy for collecting job analysis information. A preliminary data collection effort will be conducted to ensure target MOS have been classified into the appropriate clusters. A more in-depth analysis follows to collect the information needed to design the performance measure.

As part of the methodology the team developed tools to quantify the level of realism achieved in performance measures. The team also identified strategies to reduce the costs required to develop and implement them.

Findings:

No single assessment method will be effective across the diverse range of MOS in the Army. However, MOS can be grouped into a relatively small number of clusters for which the same type(s) of assessment method(s) can be used. For each group it should be possible to create a standard, streamlined approach to job analysis, assessment design, assessment development, and pilot testing. This document provides a structure and an approach to achieve this goal.

To the extent possible, we sought to identify assessment methods capable of being delivered on a personal computer. For some MOS this approach will be successful. However, there are many

predetermined standards. For such MOS some form of a hands-on measure must be a component of the assessment. We believe there are a number of viable strategies to make such assessments beyond traditional work sample tests. These include field-based hands-on performance tests and the evaluation of work products.

Utilization of Findings

For follow-up work that could be conducted, we recommend that a small sample of performance measures be developed following the strategies presented in this document. The MOS should be drawn from the different clusters identified in this effort. The resulting measures should be evaluated for their level of realism. Lessons learned from Phase II should be used to identify strategies to standardize and streamline the process of developing additional measures in each cluster.

A STRATEGY TO PRODUCE REALISTIC, COST-EFFECTIVE MEASURES OF JOB PERFORMANCE

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A STRATEGY TO PRODUCE REALISTIC, COST-EFFECTIVE MEASURES OF JOB PERFORMANCE

I. Introduction

Background

In the 1970s, the U.S. Army established an ambitious program for periodically certifying the technical skills of enlisted personnel. The Skill Qualification Test (SQT) program included both traditional multiple-choice and hands-on tests of proceduralized knowledge related to critical tasks in each military occupational specialty (MOS). Without the aid of technology-based systems and with decreasing numbers of personnel to develop and maintain the SQT, the program was gradually reduced in scope (e.g., written tests only, voluntary testing) and eventually discontinued altogether.

The SQTs were an important tool for training, promotion decisions, and selection and classification research. Today, those needs remain with no systematic assessment of MOS technical skills available to address them. Indeed, the recent Army Training and Leader Development Panel (ATLDP) recommended the Army “develop and sustain a competency assessment program for evaluating Soldiers’ technical and tactical proficiency in the MOS and leadership skills for their rank” (ATLDP, 2002, p. 34). This recommendation has been approved as a required action, with the leadership skills element to be addressed by tools from an ongoing research project, Maximizing 21st Century Noncommissioned Officer (NCOs) Performance (NCO21), sponsored by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). The products from this effort were a future-oriented job analysis for NCOs and validated tools for assessing critical future knowledge, skills, and attributes. No such tools currently exist to routinely assess technical competence. The goal of this project is to address this gap.

In addition to the concerns of the ATLDP, valid and cost-effective assessments of technical skills (and the job analysis information required to develop them) will support the full range of Army enlisted human resource requirements, including recruiting, selection, training, self-development, promotion, and transition assistance for Soldiers exiting the Army. For example, such tools will facilitate the linkage of Army training to occupational certification requirements in the civilian sector. This is a significant initiative being pursued by the Army because of its anticipated positive impact on recruiting and transition assistance.

Overall Objective

The overall objective of this effort is to devise effective and affordable means to assess the ability of Soldiers to perform the technical requirements of their MOS. To the extent possible, the Army would like to assess performance in a manner that realistically captures the complexities and demands incumbents face in doing their jobs. Rather than assess isolated tasks, the idea is to assess performance within the broader context of how each MOS is actually performed.

This research effort is supported under the Small Business Innovative Research (SBIR) program. This program promotes research for government efforts that small business can then market to the private sector. Each SBIR is structured as a three-phase effort. The first phase is the conceptual phase with products such as a detailed methodology, prototype, or conceptual demonstration. In the second phase, the research is conducted over a two-year period. The third phase is intended for the adaptation of the research products for the private sector. Following the format of SBIR efforts, our plan is to pursue performance measures in a three-phased effort.

- Phase I - Develop a methodology for creating realistic and cost-effective measures
- Phase II – Demonstrate and evaluate the methodology with up to five MOS
- Phase III - Apply methodology across Army MOS

Goals for Phase I

This document presents the methodology developed in Phase I. The methodology was designed to achieve the following goals:

- Produce realistic and affordable measures.
- Be applicable to most Army MOS.
- Produce assessments that are reliable, discriminate between acceptable and unacceptable performance, and are practical to use.
- Support administration of Soldier assessments irrespective of their location.

Key Elements to Our Methodology

Our approach involved the integration of three innovations. The first is conceptual, the second technological, and the third organizational.

Assessment Methods linked to MOS Clusters. We began with the assumption that no single type of test will yield satisfactory results for all Army MOS. Thus, we identified a set of assessment methods capable of covering the broad range of Army MOS. To gain efficiencies in the process of assessment development, we identified clusters of MOS needing specific testing strategies.

Computer-Based Testing. Our approach capitalizes on the capabilities of today's powerful multimedia personal computers and high speed data communications. In our vision, as much of the testing as possible will be conducted on a computer. For some jobs we anticipate going quite far in using the full capabilities of the computer to create a rich and engaging virtual job environment.

Continuous Process Improvement. The third innovation is organizational. It can take a substantial effort from a multidisciplinary team to produce and maintain realistic and effective performance measures, particularly those that run on computers. However, the steps in the development and maintenance systems can be described, the time and resources it takes to complete them can be measured, and interventions can be taken to make the process more and more efficient. A focus in all three Phases of this SBIR will be to identify ways to reduce the

time and costs required to perform job analysis, test design, development, evaluation, and maintenance activities.

II. Overview

Our approach is based upon clusters of MOS linked to assessment methods. Common to all MOS in a cluster is their suitability for evaluation by a specific assessment method or combination of methods. This idea is represented by the left and middle boxes in Figure 1. It is our belief that this approach offers the best chance to achieve a solution that optimizes the multiple goals of the project (i.e., realism, cost-effectiveness, validity, and practicality).

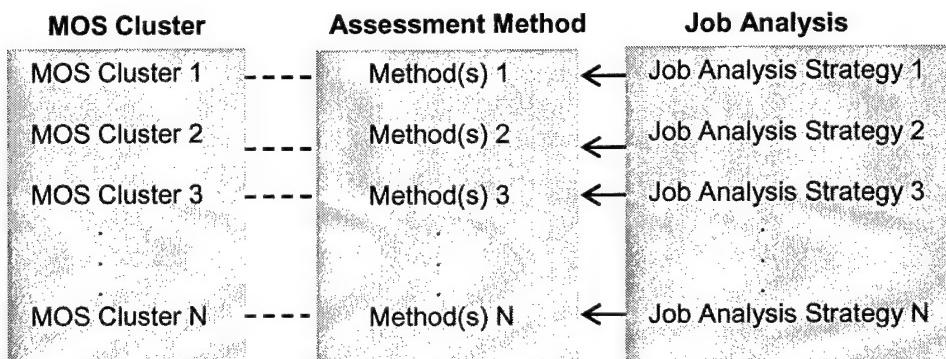


Figure 1: Depiction of the methodology.

We will devise a common job analysis approach for all the MOS in a particular cluster. This idea is represented by the box on the right side of the figure.

Our methodology takes a middle position between the extremes of trying to impose a single type of assessment approach on all Army MOS and allowing any evaluation option for every MOS. With our methodology we identify, up front, a limited and viable set of assessment strategies. These strategies are selected on the basis of their potential to achieve the goals of the project and their applicability to a broad range of Army MOS.

Linking MOS clusters to assessment methods offers the possibility of devising a standard approach to producing the assessments for the MOS in each cluster. This means the same approach can be applied to performing the job analysis, test design, and test development activities. We anticipate having a proven, streamlined process after just a few iterations of producing assessments for MOS in a particular cluster.

With some initial experience in developing such measures, it should also be possible to generate accurate estimates of the time and costs needed to create performance measures for use across the entire Army.

III. Assessment Methods

Initial Set of Methods

Members of the JPS team have had extensive practical experience in developing assessment measures used in the Army and the commercial sector. We started the process of identifying methods by simply asking team members to nominate those approaches they felt had potential to achieve the goals of the project. Table 1 presents the results of this step.

Table 1: Initial List of Assessment Methods

	Method
1.	On-the-job monitoring/assessment (embedded in relevant systems)
2.	Supervisor ratings
3.	Expert evaluation of actual work products
4.	High fidelity hands-on work sample tests (process and/or product scoring) that closely model task requirements
5.	Lower fidelity hands-on work sample tests (process and/or product scoring) requiring skipping or talking through aspects of performance (e.g., due to time/safety considerations)
6.	High fidelity simulation using Army training equipment/systems
7.	High fidelity computer-based simulation (programming, equipment, and props to closely match the real thing)
8.	Medium fidelity computer-based simulation (programming, visuals, and low cost PC attachments to obtain a reasonable approximation of the real thing)
9.	Low fidelity computer-based simulation (programming and visuals that get the message across, but does not closely match the real thing)
10.	Proceduralized knowledge multiple-choice test (liberal use of audio/visuals)
11.	Proceduralized knowledge multiple-choice test (mostly text-based)
12.	Declarative knowledge multiple-choice test (liberal use of audio/visuals)
13.	Declarative knowledge multiple-choice test (mostly text-based)

We arranged the list so that the methods appearing further up tend to offer higher levels of realism. Ordering the list in this way illustrated to us one of the challenges of this project. Those types that inherently offer greater realism tend to also be substantially more costly to design, build, administer, maintain, and upgrade.

As mentioned in the introduction of this document, our vision is that as much testing as possible be delivered via computer. Hosting tests on this platform supports a number of strategies we can pursue to reduce costs and promote realism. It can also help us facilitate test administration, improve accuracy of scoring, promote accessibility, and support test maintenance. Finally, hosting tests on this platform and recording scores at a central server can facilitate the conduct of reliability and validity studies. However, several assessment types located toward the top of the list can not be easily administered via computer. These include on-the-job monitoring/assessment, expert evaluation of actual work products, and most work sample tests.

Several types of multiple-choice tests appear toward the bottom of the list. Given the focus on realism, it may seem out of place to have included them on our list. Our thought, however, was that with some creativity, it will be useful at times to include this technique as a separate component to a test battery or to integrate it into another performance assessment technique.

When administered on a computer, questions can be presented using audiovisual stimuli and sequenced in an order that matches how tasks are actually completed. Adding in such items as electronic versions of equipment manuals, simulated test equipment, and other simulated features of the job moves the test in the direction of a virtual job.

As an aside, we had a number of exchanges among ourselves regarding what made one type of test distinct from another. For example it became clear to us that one could blur the distinctions between multiple-choice tests and simulations. We sharpened the distinctions by defining “multiple-choice” as any close-ended response format item, including ranking and “drag and drop” problems. We distinguished them from simulations in that they do not allow the examinee to interact with the test stimulus.

Changes to the List

We made several modifications to the list early in the course of the Phase I effort. Some of the changes reflected concerns about the feasibility of using particular testing methods in the Army. Some changes were made to shorten the list and make it more manageable for our purposes. Finally, some changes resulted from issues that surfaced when we considered how we might apply the test methods to a sample of MOS.

For example, an early decision was to remove supervisor ratings from the list (method 2 in Table 1). We felt the inherent subjectivity of supervisor ratings and their tendency to become inflated when used for decision-making purposes outweighed any advantages this test method might offer.

We also made an early decision to remove text-based declarative knowledge multiple-choice exams (method 13) from the list. We simply felt that this testing method was inconsistent with the goal of realism in testing. The better choice was to pursue multiple-choice testing in which the items were made to be as performance-oriented as possible (i.e., assess proceduralized knowledge). This is as opposed to questions that are posed out of any real-world context and require simple recall of facts or procedures (i.e., purely declarative knowledge).

Another decision was to combine methods 6 and 7 (high fidelity testing using existing Army equipment and high fidelity simulation developed on a computer). These methods differ only in whether or not there is an existing training simulator that might be used for testing. There was no value to us in keeping method 6 separate as it was beyond our scope to investigate for each MOS the existence of suitable simulators and their availability for testing purposes.

We also decided to modify our list of the remaining multiple-choice testing methods (methods 10, 11, and 12). We simplified the entries by dropping any distinctions between testing knowledge and procedures and instead focusing upon the difference between using relatively inexpensive visuals and more elaborate multimedia presentation techniques.

We then added a type of multiple-choice test in which the items unfold naturally within the context of job-relevant scenarios (presented via computerized simulations, video, and/or text). Such a test might consist of a series of small scenarios, focusing on different aspects of the job.

Alternatively, it could be a single large scenario that captures the essence of all key job areas. In this option, it would also be possible to incorporate some semblance of contextual factors such as interactions with others, interruptions, and time pressures.

Finally, we felt it useful to add situational judgment tests to our list. This issue arose while considering how we might assess MOS such as Military Police in which effective performance at times requires the Soldier to exercise significant levels of judgment in ambiguous or novel situations.

Our revised list of test methods appears in Table 2. The next chapter explains how we used this list to help establish MOS clusters.

Table 2: Revised Assessment Methods

	Method
1	On-the-job monitoring/assessment (embedded in relevant systems)
2	Expert evaluation of actual work products
3	High fidelity hands-on work sample tests (process and/or product scoring) that closely model task requirements
4	Lower fidelity hands-on work sample tests (process and/or product scoring) requiring skipping or talking through aspects of performance (e.g., due to time/safety considerations)
5	High fidelity computer-based simulation (programming, equipment, and props to closely match the real thing) that may make use of Army training simulators
6	Medium fidelity computer-based simulation (programming, visuals, and low cost PC attachments to obtain a reasonable approximation of the real thing)
7	Low fidelity computer-based simulation (programming and visuals that get the message across, but does not closely match the real thing)
8	Multiple-choice “simulation” (items organized into one or more cohesive scenarios using audio/video clips and some computerized simulation; despite their inherent interdependence, items are designed to be as independent as possible)
9	Multiple-choice situational judgment test (with or without audio/video clips)
10	Multiple-choice test (using audio/video clips and some computerized simulation)
11	Multiple-choice test (using simple visuals such as photos, figures, and graphs)

IV. Identification of MOS Clusters

We scheduled a workshop on June 17, 2003 to generate the MOS clusters. In advance of the workshop, we prepared a set of materials for use by participants.

Workshop Materials

The first item in the set was the list of revised assessment methods that appear in Table 2. The second item was a list of 11 MOS characteristics we felt should underlie decisions about which test methods were most appropriate for jobs. This list appears in Appendix A. As an example, one characteristic was the extent to which the procedural knowledge and skill in manipulating objects was required in job performance. Jobs high on this characteristic would likely entail significant amounts of physical action. This characteristic in turn might suggest a cluster of MOS in which the ideal testing method would be some sort of hands-on work sample test.

As another example, Appendix A contains a characteristic we called systems thinking. This we defined in terms of needing to manage processes characterized by a number of fairly complex, interrelated elements. This characteristic might suggest another cluster in which simulations would be the best type of test method to use.

A third item for participants' use was a set of 50 descriptions of Army MOS derived from U.S. Army Pamphlet 611-21 (Department of the Army, 1999). The list covers all MOS that exist at Skill Level 1 (or may exist at this level in the future). The descriptions were typically half a page to a full page in length. Each was headed with a job number and a job title. This was followed by a brief description of the major duties. Next was a sentence or two describing the requirements at skill levels 1 and 2. The descriptions also indicated whether the MOS was open to women and the level of physical demands. As an example, a description for Cannon Crewmember appears in Appendix B.

The 50 descriptions were actually a sample of a larger set of roughly 175 descriptions that had been previously generated as part of the Select21 project. The order of the list was randomized so that the 50 we used in the workshop were reasonably representative of the entire set.

The fourth item was a list of all the potential job analysis methods we might use to help design the tests we would construct in Phases II and III of this effort. We identified seven methods:

- Direct observation
- Analysis of existing materials
- Interviews
- Subject matter experts
- Cross-job questionnaires
- Within-job questionnaires
- Critical incidents/scenarios

Definitions of these methods appear in Appendix C.

Workshop Pilot Test

On June 10, 2003 three project staff members and a representative from ARI met to review the workshop materials and to try out the clustering process with four MOS descriptions. This activity led us to add clarifying descriptions to some of our materials. It also emphasized the value of having participants among us who were knowledgeable enough about the MOS to answer questions as we attempted to generate clusters.

Workshop Process

Six individuals participated in the clustering workshop¹. We began the event by reviewing the goals of the project and the advantages we hoped to achieve with them in completing Phases II and III of the SBIR project. We explained that a good clustering solution would be one with a manageable number of groups (i.e., three to ten clusters) and be based on aspects of MOS that related directly to the choice of test methods.

We provided the resource materials to each participant and offered examples of how one could take a description of an MOS, apply the other resource material to it, and place the MOS into a possible cluster. Each participant was provided the same randomized set of MOS descriptions. Given time constraints, we restricted the number of MOS to 50 rather than use the entire set of 175. Participants had approximately 2.5 hours to work independently in constructing their cluster solution. The focus of this clustering exercise was to put MOS together that shared characteristics (e.g., procedural knowledge and skill for manipulating objects, level of cognitive complexity) suggesting a common subset of preferred assessment methods.

Participants described the clusters they each identified. The group then arrived at a consensus decision on a set of seven clusters. For each cluster, the group assigned a type of test or combination of tests to it. To better understand the meaning and utility of the clusters, the group sorted all 50 MOS into them. The following week, two members of the JPS team finished sorting the remaining MOS into the same seven clusters.

MOS Cluster Results

Appendix D shows how each MOS was sorted. We caution the reader that these results are preliminary and MOS will likely be moved among clusters as we gain more information about them in future SBIR phases.

Table 3 contains summary information about the clusters. As the second column shows, we found the number of MOS per cluster varies greatly. The smallest, Cluster 6 could have just a single MOS. The largest, Cluster 4, likely has well over a 100.

¹ The judges included John Campbell, Roy Campbell, Peter Greenston, Deirdre Knapp, Doug Rosenthal, and Christopher Sager.

Table 3: MOS Clusters

Cluster	Estim. # MOS in Cluster	Example of MOS in Cluster	Assessment Environment	Assessment Items
1	15	Personnel Admin. Specialist	Virtual Job	Independent multiple-choice items
2	28	Human Intelligence Collector	Virtual Job	Multiple-choice items presented as part of job scenarios
3	5	Broadcast Journalist	Real Job	Evaluation of final work products
4	110	Cannon Crewmember	Virtual Job	Multiple-choice items (presented independently or as part of scenarios)
			Real Job	<ul style="list-style-type: none"> • Hands on demonstration • Evaluation of final work products • Embedded on-the-job monitoring • Historical records
5	4	Common Ground Station Operator	Virtual Job	Multiple-choice items
			Virtual Job	Low to medium fidelity interactive simulation
6	1	Air Traffic Controller	Virtual Job	Multiple-choice items
			Virtual Job	High fidelity interactive simulation
7	7	Military Police	Virtual Job	Multiple-choice items
			Virtual Job	Situational judgment test items
			Real Job	<ul style="list-style-type: none"> • Hands on demonstration • Evaluation of final work products • Embedded on-the-job monitoring • Historical records

The assessment environment (column 4) concerns whether performance should be assessed with a PC, with some type of on-the-job activity, or both. The term *Virtual Job* is used to convey the vision of using a PC to display some type of engaging, realistic testing environment, even if the test questions are simply multiple-choice items. The Virtual Job might show photographs, maps, diagrams, equipment manuals, and other job relevant documents. It might use video clips. It might even provide simulated test equipment.

The last column in the table indicates the kind of evaluation items we believe are appropriate. For virtual environments they range from multiple-choice items to the outcomes that occur in interacting with a high fidelity simulation. The last column in Table 3 provides information about the specific testing methods we recommend for each cluster.

For many MOS, we decided some type of hands-on test was needed. A traditional work sample test would be an example of such a test. This was the case for MOS sorted into Clusters 3, 4, and 7 (denoted by the term Real Job in column 4). Many jobs in these clusters appear to require that a trained evaluator observe the person performing a physical action to a predetermined standard.

Those MOS in Cluster 3 can be assessed solely by means of a hands-on test. Those in Cluster 4 would be assessed using a hands-on test in combination with a PC delivered multiple-choice test. Those in Cluster 7 might need a situational judgment test as part of the testing battery.

It is not reasonable, however, to expect the Army to fund the development and implementation of traditional work sample tests considering the large number of MOS in these clusters (particularly Cluster 4). We therefore identified four alternative approaches to collecting on-the-job information. These are hands-on-demonstration tests, evaluation of final work products, embedded on-the-job monitoring, and historical records.

Alternatives to Traditional Work Sample Tests

Hands-On-Demonstration Test

The concept here is that the Soldier and supervisor are given much of the responsibility to conduct the testing event themselves. During this event Soldiers perform job tasks (as part of their normal job) and are evaluated/certified by a supervisor. The Soldier and supervisor would be given a set window of weeks or months in which to complete this assignment. Perhaps the final decision the supervisor makes is dichotomous. That is, a go (task done right)/no go (task not done right - still needs to learn the job better and be re-evaluated later).

Our role would be to structure the process to ensure the soldier and supervisor perform it correctly. We would provide training to the supervisor (over the web) on performance assessment. The training would cover how to use the task checklist we send (over the web), how to work in the testing process as part of their other duties, how to evaluate if task performance is acceptable (determine if the soldier achieved the standard), how to give appropriate feedback, and how to enter the results in a data base.

In combination with some type of computer delivered knowledge test taken by the solider, this might be a very workable solution for many MOS in Cluster 4. It would be in line with the emphasis the Army now puts on teaching level 2 and beyond Soldiers how to train and evaluate training results. As a side benefit, it might make supervisors throughout the Army significantly more skilled in determining the proficiency of their Soldiers. This would complement their traditional focus on training.

Evaluation of Final Work Products

There appear to be some jobs in which the incumbent can be asked to submit a sample of final work products for review. This may, in fact, be the only strategy that makes sense for jobs such as multimedia artist, journalist, or translator. The products could be evaluated by the supervisor or a panel of experts.

Embedded On-the-Job Monitoring

Given the increasing use of technology in MOS, there may be significant opportunities for technology to play an increasing role in capturing job performance.

Historical Records

Finally, for a few jobs, it may make sense to review historical data on a Soldier's performance in a job. Consider the job of a parachute rigger. We understand that any incident resulting from problems in the inspection or packing of a parachute can be tracked back to the person who prepared it.

V. Job Analysis Strategies

Overview

We envision a 2-stage job analysis process. In the first stage, a “preliminary” job analysis will be conducted to confirm *a priori* decisions regarding the job cluster a given MOS has been assigned to, and by implication, the measurement method(s) that will be used to form the performance assessment. The second stage of the job analysis will provide the information needed to design the assessments. It will provide the basis for content specifications, but not necessarily all the content (e.g., video clips) required to support measure development.

During the course of the 2-stage job analysis work, there will be some information we anticipate collecting for all jobs:

- (1) A delineation of the major job activities (e.g., tasks, task categories, roles) that can be used to ensure the assessment(s) cover relevant material and are suitably comprehensive in scope.
- (2) An understanding of contextual factors, such as the degree of interaction with others, the need for multi-tasking, and so forth that can be used to infuse the assessment experience with realism.
- (3) An understanding of how the job is performed and to what standard (e.g., as depicted in Soldier’s Manuals), which becomes the basis for determining the “right answers” and assessing performance.

Issues

The performance assessments developed for the Army are expected to be realistic and cost-effective. An important strategy for incorporating realism into an assessment involves having a holistic view of job requirements. Major drivers on the cost-effectiveness issue include having assessments with a reasonable life cycle (i.e., do not require constant changes to keep them up-to-date) and that do not involve separate measures for Soldiers with different assignments. Our proposed methods for collecting preliminary and full job analysis information are designed to address, inasmuch as possible, several factors that complicate performing job analysis work that supports these goals. Those factors include:

- Unit differences in job requirements and equipment.
- Swiftly evolving job requirements and equipment.
- Traditional focus on detailed job tasks.
- Differences in field, school, and doctrinal perspectives.

For example, the Army’s traditional focus on a very fine grain task analysis – which might be more appropriately termed learning objectives – could lead an analyst away from a more holistic approach to performance assessment. Detailed tasks can also change fairly quickly whereas broader job descriptors are likely to be more stable. At the same time, an approach is needed that provides sufficient depth to answer the many questions that arise in measure development.

Another issue is the utility of available sources of job information. Soldier's Manuals that detail task requirements for each MOS are in various stages of currency. The Army Occupational Survey Program provides another obvious source of job analysis information, but the adequacy of the information varies considerably across MOS. For this reason, the same basic job analysis procedure applied to two different MOS may vary considerably in resource requirements due to differences in the availability of up-to-date, quality information from existing sources.

Preliminary Job Analysis

As mentioned above, the primary goal of the preliminary job analysis is to collect sufficient information about selected MOS to determine whether each has been assigned to the correct job cluster. Confirmation of this assignment will allow us to (a) make a final determination of the types of measures to develop for each target MOS and (b) design the detailed job analysis approach for each MOS so that it will be efficient and support the development of the necessary assessments.

The procedure, materials, and results from the job clustering exercise serve as a good starting point for this stage. For example, the list of MOS characteristics (Appendix A) outlines much of the information that is important for identifying the appropriate combination of measures for assessing performance in an MOS. The clustering exercise also revealed that more information is needed to confirm our initial assignments of MOS to clusters. One issue was that participants felt that the MOS descriptions used in the exercise did not have enough information to allow them to make confident assignments. Additionally, it became apparent that some information not formally considered during the exercise might affect cluster assignments. For example, if an MOS is very small or about to be collapsed into another, it might not be cost effective to develop an expensive simulation for that MOS.

Proposed Procedure

With these goals and this recent experience in mind, we propose the following procedure. The primary product will be a completed *Preliminary Job Analysis Form* for each target occupation. The information contained in these forms will help to confirm the cluster assignment and design the rest of the job analysis approach for each MOS. Appendix E contains the following support materials:

- *Instructions for Job Analysts: Completing the Preliminary Job Analysis Form*
- *Example Preliminary Job Analysis Form (11B Infantryman)*
- *Taxonomy of Potential Major Work Activities*
- *Definitions of MOS Characteristics*

The *Preliminary Job Analysis Form* includes three major sections. The first is titled *Major MOS-Specific Activities*. The idea here, as described in the instructions, is to use a broad taxonomy of work activities to identify and describe the most important elements of the MOS in terms of MOS-specific work activities (e.g., Entering buildings during an urban operations and Zeroing a

weapon)². These work activities will serve at least two purposes: (a) they will support inferences about the required knowledges and skills and (b) they will offer early suggestions about assessment content.

MOS Characteristics is the second section. It includes characteristics that project staff identified as relevant to determining appropriate measurement methods during preparation for the clustering exercise. *MOS Characteristics* includes four subsections; the first is *Determinants of Performance*. The determinants of performance are derived primarily from the job performance modeling literature (e.g., Campbell, McCloy, Oppler, & Sager, 1993; Campbell & Kuncel, 2001). The theory states that two important determinants of job performance are Declarative Knowledge (DK) and Procedural Knowledge and Skill (PKS). DK is defined as knowledge of facts and things, while PKS is defined as the successful combination of “knowing what do” with “knowing how to do it.” PKS is especially apparent when mastery depends on practice (e.g., word processing and interacting with the public). The extent to which performance on a job is determined by DK or a particular PKS can have a substantial influence on the selection of measurement methods. For example, if DK is the primary determinant of performance, some kind of multiple-choice test is likely to work. However, if the PKS *Manipulating Objects* is an important determinant of performance, then including a hands-on measure that can test that skill may be necessary.

The remaining MOS characteristics are described in *Definitions of MOS Characteristics*. They include *Cognitive Complexity*, *Work Context*, and *Tools, Equipment and Systems*. Cognitive complexity addresses issues relating to the level of cognitive demand the MOS places on the individual Soldier. For example, Air Traffic Controller is an occupation that places a substantial cognitive demand on the incumbent; whereas, the level of cognitive demand placed on a Ticket Taker is somewhat less. *Work Context* addresses elements of the work environment that we think are relevant to the identification of appropriate measurement methods. The items were derived primarily from the Work Context portion of the Occupational Information Network (O*NET) taxonomy (Strong, Jeanneret, McPhail, Blakely, & D'egidio, 1999). *Tools, Equipment, and Systems* will be a list of the major tools, pieces of equipment, and systems that are used by all or most of the Skill Level 1 Soldiers in the target MOS.

The last part of the form is *Practical Considerations*. Here we include additional information that is relevant to developing performance measures for this MOS. Practical considerations will include the likely future of the MOS and an estimate of the number of Skill Level 1 Soldiers currently in the MOS. This kind of information is important because it might impact decisions about the practicality or cost-effectiveness of developing certain kinds of assessments for particular MOS.

The *Instructions for Job Analysts: Completing the Preliminary Job Analysis Form* describe the process we propose for completing this form. It includes a review of existing materials (e.g., task lists and Soldier manuals) to develop an initial draft, an interview (that might include direct

² The Taxonomy of Potential Major Work Activities in Appendix G is derived from the O*NET generalized work activities (Jeanneret, Borman, Kubisiak, & Hanson, 1999). An alternative we are considering is based on the Army Synthetic Validation project (Wise, Peterson, Hoffman, Campbell, & Arabian, 1991).

observation), and a series of project staff reviews that result in a final and complete version of the form.

Confirmation of Cluster Assignments

Individual project staff members and sponsor representatives will then review the information in the preliminary job analysis forms. This review will be followed by a consensus meeting to confirm and/or adjust the measurement approach cluster assignments for target MOS. Important considerations will include:

- If an MOS is dominated by DK and PKS is not that important, some form of multiple-choice test is likely to be sufficient.
- If an MOS includes a lot of manipulating objects (i.e., a PKS) that require well-developed physical and/or psychomotor skills to perform important activities, some kind of hands-on, work sample, or imbedded on the job monitoring will be necessary.
- MOS in which performance depends substantially on PKSs like interacting with others, using information resources, reading, and/or writing will need an assessment approach that addresses these skills. Possibilities include computer simulations, situational judgment tests (SJT), and evaluations of final work products.
- MOS that involve a substantial amount of judgment/problem solving in situations that are not easily addressed by specific knowledge(s) or skill(s) are likely to require a set of assessments that include an SJT or some kind of simulation that can present these situations with sufficient fidelity.
- If an MOS requires a great deal of systems thinking, its performance measures will probably need to include a simulation that requires the Soldier to deal with a number of interdependent pieces of information, decisions and/or required outputs.
- Information about work context, tools, equipment, and systems will help to further identify characteristics assessments for individual MOS should address. Some examples include:
 - If a substantial portion of the work for an MOS takes place via a computer/visual display, a computerized simulation is likely to have high validity and realism.
 - If dealing well with time pressure and interruptions is important to job performance in an MOS, this can be simulated by some of the proposed measures.
 - If skill in the use of a particular tool or piece of equipment (e.g., a personal weapon) is very important, a hands-on test covering it may be necessary.

Full Job Analysis

The full job analysis is designed to collect enough information to design the performance assessment(s) identified for the target MOS. As shown in Figure 1, the job analysis method will be linked to the requirements of the test method(s) associated with each job cluster. Particularly given that we expect the clusters themselves to evolve as we move into Phase II, we will not try to delineate full job analysis procedures in great detail. Rather our goal here is to provide an idea of how the procedures are likely to vary across clusters.

Methods Common to All Job Clusters

A broad list of job analysis methods is provided on page 11 and detailed in Appendix C. We recommend that some of these methods be used for all MOS, regardless of job cluster. Specifically, all job analyses will include analysis of existing materials, at least one SME workshop, and a field survey of incumbents and/or supervisors. (Table 4 shows our initial recommendations about the job analysis methods applicable for each job cluster.)

Table 4. Job Analysis Methods by Job Clusters

Cluster/ Method	1	2	3	4	5	6	7
Direct observation				X			X
Analysis of existing docs	X	X	X	X	X	X	X
SME Interviews					X	X	
SME Workshops	X	X	X	X	X	X	X
Cross-job surveys							
Within job surveys (broad)			X				
Within job surveys (detailed)	X	X		X	X	X	X
Critical incidents/scenarios							X

The first SME workshop may be conducted in conjunction with completion of the *Preliminary Job Analysis Form*. Subsequent workshops may be needed to provide sufficient feedback on the list of major work activities to use in a survey. What will be different across clusters is the level of detail at which major work activities must be defined and prioritized through SME workshops and a field survey.

Common to all job analyses will be work activities/job descriptors organized into the generic work activities discussed in the preliminary job analysis section. Our goal is to include job-specific information as needed but try for efficiencies of process by attempting to stay within the organizing structure of the modified O*NET work activities (Peterson, Mumford, Borman, Jeanneret, & Fleishman, 1999). In all cases, job descriptors within the major work activities will be less detailed than the tasks the Army has traditionally used for training (which might be more appropriately called learning objectives). For clusters requiring multiple-choice or hands-on tests, the job descriptors will need to be more detailed (e.g., broadly-worded tasks) than the other clusters (major job functions or task categories).

SME workshops. To the extent possible, we will use existing materials to craft the work activities that will be embedded in the field survey. SME workshops will be used as needed to finalize the list. SMEs will be identified through the applicable proponent schools. In Phase II, we want to try conducting at least some SME workshops in a virtual environment (e.g., using web-supported teleconferences) as a cost-savings measure.

Field survey. We propose using automated surveys to collect data for prioritizing work activities for measurement. We recommend using the AUTOGEN software ARI's Occupational

Analysis Office (AO) has developed to collect the required data (U.S. Army Training and Doctrine Command, 2004). Unlike the current use of AUTOGEN, which was designed so that proponents could conduct job analysis work without additional support from ARI, we would require that professional job analysts familiar with project requirements participate in the entire process. The sampling plan for each survey would be worked out with the MOS proponent.

Methods for Selected Job Clusters

Direct observation. Clusters #4 and #7 involve hands-on tests that will likely require direct observation of work performance to design, particularly given the goal of high fidelity testing that provides a realistic context for the testing situation.

SME interviews. Some assessment methods, particularly those requiring computerized simulations, will require focused time with individual SMEs to collect the detailed “walk-through” information needed to design the simulations.

Critical incidents/scenarios. Development of a situational judgment test (SJT) will require job analysis information that (a) identifies the critical behavioral areas that should be covered on the test and (b) serves as the raw material for developing questions. Therefore, critical incident/scenario workshops with job incumbents will be required for those MOS in Cluster #7. Again, we recommend trying to conduct some of this workshop activity using virtual meetings supported by technology.

Job Analysis Updates

If it is to support up-to-date assessments without undue resource burdens, an important feature of the job analysis procedures will be to incorporate routine mechanisms for updating information (Knapp, Morath, Quartetti, & Ramos, 1997). This contrasts with the traditional expectation that a big job analysis is conducted every 3-5 years. At a minimum, this would entail re-administration of the field survey to a relatively small sample of respondents every 12 months or so. Introduction of new equipment or other known MOS changes could lead to adjustments in this schedule. Such changes might also be addressed by conducting an interim survey that focuses only on those aspects of the job expected to be affected by the changes in progress.

VI. Process Improvement Strategy

It will require a significant level of resources to produce and implement performance measures throughout the Army. However, the steps to the process can be documented, time and cost metrics can be developed, and strategies can be applied to achieve continuous improvements in efficiency.

The work required to build, implement, and maintain performance measures in the Army can be divided into seven main activities. Each activity represents a target for continuous improvement.

Table 5: Targets for Process Improvement Activities

	Activity
1.	Preliminary Job Analysis
2.	Full Job Analysis
3.	Design
4.	Development
5.	Pilot Test
6.	Implementation
7.	Support and Maintenance

Current Strategies to Achieve Cost-Effective Measures

Our goal in Phase I was to devise a methodology in which cost effectiveness was an inherent feature. The identification of clusters of MOS tied to test methods represents our core strategy to achieve this result, while simultaneously achieving the requirements for realism and validity.

The previous chapter outlined a strategy to create a standard, efficient process for collecting the job information we will need to ensure MOS have been assigned to the correct cluster and to design the measures. This will clearly be a fruitful area for us to revise and streamline over time. Our team has found that roughly two-thirds of the labor hours we spend to produce job simulations are devoted to the job analysis and design activities.

One strategy we have already developed to make the design and development process more efficient is to produce a written document up front that answers many of the questions we need to know to achieve a successful product. This document also helps reduce misunderstandings between our team and the client.

Appendix F contains a customized template for producing such a document in our Phase II work. The result will be a separate design guide we will create for each measure we develop. It will be completed as an initial step in the design phase of the work. We will provide a copy to ARI and the MOS proponent and indicate those sections for which we request their approval prior to our starting development work.

Section XI of the template requires the project manager to establish and describe specific process improvement goals. These may include new tools, procedures, or templates that will be developed and evaluated to make the process of developing another test like it (i.e., an MOS in

the same cluster) more standardized and streamlined. Our team has a formal mechanism to identify ideas to improve our work. We have designed what we call a “post-mortem” meeting. This is both a celebration of the completion of a project and a serious discussion among all contributors about what went well and what we might do better next time.

For each formal process improvement initiative we undertake in Phases II and III, we will collect quantitative and qualitative data to evaluate our success. A key metric we will track is the number of hours we expend in each project activity. We have a web-based time keeping system hosted on a server. For any project we can list the specific tasks (and subtasks). Contributors can then indicate what specific areas of the project they performed as they enter their hours. The system makes it very easy to calculate total hours spent on any portion of a project. We will use this system to determine the effectiveness of our improvement initiatives in reducing labor hour requirements.

Future Effort to Achieve Additional Efficiencies

The purpose of Phase II will be to conduct a feasibility study of our methodology with a small sample of MOS. Thus, by design we will be particularly focused on devising and improving procedures associated with activities 1 through 5 in Table 5. In Phase III, our focus expands to include full implementation, support, and life cycle maintenance (i.e., activities 6 and 7).

One of the more intractable bottlenecks we experience with our clients is having access to their SMEs. Among the solutions we have considered at JPS are ways to use the internet to better communicate and exchange information. We have already noted our interest in pursuing this medium to more efficiently perform job analysis tasks. We believe this is just one of several opportunities that exist to develop methods of making better use of SMEs. We anticipate this being one of several areas we will explore for process improvement initiatives in Phases II and III that can lead to savings in both costs and time required to produce and maintain performance measures.

VII. Meaning and Measurement of Realism

We began the Phase I effort with a review of the scientific literature on realism in performance measures. Our goal was to identify a definition of the concept and develop an operational measure of it (Rosenthal, 2003). However, our literature review suggested that realism in test performance has received little critical analysis and there is no generally accepted definition of it.

For our purposes we defined realism as a combination of the test's physical and psychological fidelity to the job. Of paramount importance to achieving physical fidelity is that:

- There is a close match between the stimuli and response options afforded on the test and in the job
- Important contextual features that facilitate or inhibit performance on the job are represented in the test

Of paramount importance to achieving psychological fidelity is that the content of the test (i.e., the challenges, situations, and scenarios) are relevant and well constructed. There are other features to a test that can add to its overall level of realism. Whether their impact works through improving the physical or psychological fidelity is not clear. These include the pace/intensity of the action and the extent to which the events cover significant portions of the job (e.g., complete tasks, duties, or activities).

For computer-administered tests, we developed rating scales that can be used to produce a quantitative measure of the extent to which they are realistic (See Appendix G). We will use these scales to help evaluate our success in achieving satisfactory levels of realism in tests we create in Phases II and III.

VIII. Conclusions and Recommendations

The results of this effort support the conclusion that MOS can be grouped into a relatively small number of clusters for which the same type(s) of assessment method can be used. As a result, it appears likely that a standard, streamlined approach to job analysis, test design, test development, and pilot testing can be developed for each cluster.

The workshop experience convinces us that some of the MOS we assigned to clusters need to be examined more closely in the future and possibly reclassified. Our team lacked the in-depth knowledge of each MOS needed to ensure all classifications were correct. However, our methodology, which includes a preliminary job analysis, should correct this problem.

While we identified seven groups of MOS, the number of MOS in each group varied widely. In fact, the two clusters requiring interactive simulations appear to have very few MOS in them. The Army may therefore decide not to make them a priority for evaluation in Phase II.

On the other hand, one cluster contained well over a hundred MOS. In Phase II we will determine if this cluster deserves to be further divided. Our current thinking is that this is likely. The subdivision may be among different strategies to collect hands-on data. It may also be divided among those MOS having useful existing job information (e.g., up-to-date Soldier's Manuals) and those lacking any useful job information.

To the extent possible, we hoped to assess performance using methods delivered on a personal computer. For some MOS this approach will be successful. However, there are many MOS in which it is critical that the Soldier perform a series of physical actions to predetermined standards. For such MOS some form of on-the-job assessment must be a component of the testing. We believe there are a number of viable strategies to make such assessments beyond traditional work sample tests. These include hands-on demonstration tests and the evaluation of work products.

The focus of our efforts was upon MOS performance at Skill Level 1. It seems logical to assume that the need for using cognitive skills will generally increase while the need for physical skills will generally decrease at higher and higher skill levels. Thus, at the next level (i.e., Skill Level 2), the need for hands-on assessment may decrease and relatively more Soldiers may be effectively assessed using just a computer.

For Phase II we recommend that a small sample of performance measures be developed following the strategies presented in this document. The MOS should be drawn from the different clusters identified in this effort. The resulting measures should be evaluated for their level of realism. Lessons learned from Phase II should be used to identify strategies to standardize and streamline the process of developing additional measures in each cluster.

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Appendix A

MOS Characteristics

1. Declarative Knowledge – knowledge of facts and things; including lists of steps in a procedure (i.e., knowing what to do). Test items/scenarios addressing declarative knowledge focus on asking incumbents how they do their work.

Note: In very practical terms this means knowledge (including some knowledge application) that could be assessed with a multiple-choice test, including test items with graphical, audio, and/or visual stems and/or response options.
2. Procedural Knowledge & Skill (PK&S)/Manipulating Objects³ – (e.g., assembling a weapon, operating a cash-register, aiming a large weapon)
3. PK&S/Interacting with others – effective interaction with others (e.g., customers, patients, team members);
 - Interpersonal Skills
 - Listening
 - Speaking
4. PK&S/Using information resources – looking stuff up in a manual, data base, or intra/internet
5. PK&S/Reading
6. PK&S/Writing [Reading and writing refer specifically to activities required by the job, not to these skills in the general context.]
7. Cognitive Complexity – complex decision-making, judgment, and/or processing a lot of information at once
8. Systems Thinking – understanding a “system” with a number of interrelated elements that affect each other. Examples of jobs high on this characteristic include, Air Traffic Controller, Water Treatment Specialist, and Dispatcher. An MOS completely lacking in this characteristic would be one in which very few of its tasks are dependent on each other (i.e., a number of discrete tasks where performance on one tasks is not affected by performance on the others).
9. Time pressure/decision speed – performing work or making decisions quickly
10. Computer/Visual Display – The MOS takes place primarily on a computer or some other type of visual display
11. Judgment – work in the MOS is characterized by a fair number of situations where the Soldier needs to exercise judgment regarding problems that are not easily addressed by a specific piece of knowledge or skill [Here we are thinking about Critical Incidents and/or SJT scenarios. Situations in which judgment might be important, even for Skill Level 1 Soldiers: (a) there is a regulation, rule, or procedure, but recognizing that it is relevant or necessary to follow is difficult for some; (b) the manuals don’t cover this (a lot of interpersonal, team, and leadership stuff might fall in this category); and (c) different, potentially contradictory, policies seem to be relevant to the situation.]

³ The following definition applies of all of the PK& S characteristics. Procedural Knowledge & Skill – the successful combination of “knowing what to do” with “knowing how to do it;” this is especially prominent when mastery depends on practice (e.g., word processing or interacting with customers). Test items/scenarios addressing procedural knowledge focus on requiring incumbents to simulate doing part of their work.

Appendix B

Sample MOS Description

Job Number: 3

Job Title: Cannon Crewmember

Major Duty: Supervises or serves as a member of field artillery weapon systems.

Skill Level 1: Establishes and maintains radio and wire communications. Maintains, prepares, and loads ammunition for firing. Stores, maintains, and distributes ammunition to using units as a member of battery or battalion ammunition section. Operates and performs operator maintenance on prime movers, self-propelled howitzers, ammunition vehicles, and other unit vehicles. Performs crew maintenance and participates in organizational maintenance of weapons and related equipment.

Skill Level 2: Supervises handling, transportation, accountability, and distribution of ammunition. Assists section chief in supervision of howitzer operations, maintenance, and training. Lays weapon for direction, conducts bore sighting and basic periodic tests. Supervises the operation, loading, and maintenance of the Field Artillery Ammunition Support Vehicle.

Gender: closed to women

Physical Demands: very heavy

PhysP PhysU PhysL PhysH PhysE PhysS

Physical Profile: 2 2 2 2 2 1

Clearance Level: none

Skill Level > 1: No

Appendix C
Potential Job Analysis Strategies
for use with MOS Clusters

1. Direct Observation – job analysts observe incumbents performing work. Information can be collected in a narrative format or in some more structured way (e.g., checklist, rating scales, worksheet, etc.)
2. Analysis of Existing Materials – job analysts extract information from existing job related artifacts including:
 - o Standard Operating Procedures (SOPs)
 - o Manuals
 - o Equipment/tools
 - o Training texts, workbooks, and test items
 - o Previous job analysis results
 - o Published performance or certification standards
3. Interviews – job analysts conduct interviews of incumbents and/or supervisors. Interview can cover topics such as (a) tasks, (b) knowledges, skills, and attributes (KSAs), and (c) the relative importance of these characteristics. This category includes “protocol analysis” where an incumbent is asked to provide a narrative of physical and mental behaviors as they are performing (or pretending to perform) an element of the job.
4. Subject Matter Expert (SME) Workshops – this method collects the same types of information as interviews with the exception that average or consensus ratings and judgments can be collected.
5. Cross-job Questionnaires – generally incumbents, supervisors, or analysts rate the importance, level required, and/or frequency of particular task, activities, or KSAs relative to the performance of the job. Cross-job questionnaires include characteristics (e.g., activities, abilities, or skills) that could be thought of as applying to multiple jobs or any job (e.g., the O*NET skills, abilities, and work styles).
6. Within-job Questionnaires – this method collects the same types of information as cross-job questionnaires except that items tend to be job specific. For example, the tasks on a Plumber questionnaire would all be things that Plumbers probably do and an office manager would endorse almost none of these tasks
7. Critical Incidents/Scenarios – the collection of a series of anecdotes about on the job behaviors that tend to be examples of particularly good or poor performance. They are generally collected from incumbents and/or supervisors. Critical incidents have three essential parts: (a) a description of the situation that led up to the incident, (b) a description of what the individual did in response, and (c) a description of the consequences of the response. The word scenario in this method’s title refers to the notion that some variations involve the collection of richer, more detailed, descriptions of events than the traditional “critical incident” technique.

Appendix D

MOS Clusters

Cluster 1: Multiple-Choice Questions

ID Number	MOS Title
4	Water Treatment Specialist
6	Bridge Crewmember
25	Animal Care Specialist
38	Food Service Operations
39	Signals Collection/Identification Analyst
57	Imagery Analyst
93	Medical Supply Specialist
98	Communications Locator/Interceptor
122	Signals Intelligence Analyst (SIGINT Analyst)
135	Ground Surveillance Systems (GSS Operator)
127	Veterinary Food Inspection Specialist
131	Mortuary Affairs Specialist
137	Psychological Operations Specialist
141	Hospital Food Service Specialist
159	Personnel Administration Specialist

Cluster 2: Multiple-Choice Questions Presented as Part of Scenarios

ID Number	MOS Title
5	Patient Administration Specialist
24	Multiple Launch Rocket System Repairer
42	Human Intelligence Collector (HUMINT Collector)
43	PATROIT Fire Control Enhanced Operator/Maintainer
46	Supply Specialist
47	Administrative Specialist
56	Counterintelligence Agent
75	Aviation Operations Specialist
78	Finance Specialist
80	Cryptologic Linguist
82	Petroleum Laboratory Specialist
92	Military Intelligence Systems Maintainer/Operator
96	Automated Logistical Specialist
100	Personnel Services Specialist
104	Personnel Information System Management Specialist
105	Telecommunications Terminal Device Repairer
110	Accounting Specialist
112	Multi-channel Transmission Systems Operator-Maintainer
113	Fire Support Specialist
123	Transportation Management Coordinator
128	Satellite Communication Systems Operator-Maintainer
138	Cannon Fire Direction Specialist
143	Paralegal Specialist
145	Pharmacy Specialist
148	Preventive Medicine Specialist
156	Radar Repairer
160	Information Systems Operator-Analyst
161	Civil Affairs Specialist (Reserve Components)

Cluster 3: Evaluations of Final Work Products

ID Number	MOS Title
7	Journalist
36	Combat Documentation/Production Specialist
34	Broadcast Journalist
116	Multimedia Illustrator
175	Translator/Interpreter (Reserve Components)

Cluster 4: Multiple-Choice Questions Presented Alone or as Part of Scenarios and Evaluation of Actual Performance

ID Number	MOS Title
1	Heavy-Wheel Vehicle Mechanic
2	Self-Propelled Field Artillery System Mechanic
3	Cannon Crewmember
8	Parachute Rigger
9	Fire Control System Repairer
10	AVENGER System Repairer
12	Microwave Systems Operator-Maintainer
13	Medical Laboratory Specialist
14	Explosive Ordnance Disposal (EOD) Specialist
15	Plumber
16	Aircraft Powertrain Repairer
17	Indirect Fire Infantryman
19	Cargo Specialist
20	Healthcare Specialist
21	AH-64 Attack Helicopter Repairer
22	Dental Specialist
23	Combat Engineer
26	Aircraft Pneudraulics Repairer
28	Petroleum Supply Specialist
29	Network Switching Systems Operator-Maintainer
30	Light-Wheel Vehicle Mechanic
33	Avionic Communications Equipment Repairer
35	Topographic Surveyor
40	Avionic Mechanic
41	Track Vehicle Mechanic
44	M1 Armor Crewman
45	Land Combat Electronic Missile System Repairer
48	Multiple Launch Rocket System Crewmember
50	Infantryman
52	Operating Room Specialist
53	UH-60 Helicopter Repairer
54	MLRS Operations/Fire Direction Specialist
55	Optical Laboratory Specialist
58	Integrated Family of Test Equipment Operator & Maintainer
59	Small Arms/Artillery Repairer
60	Tactical Automated Fire Control Systems Specialist
61	Crane Operator
62	Utilities Equipment Repairer
63	Interior Electrician
64	PATRIOT Launching Station Enhanced Operator/Maintainer

65	Medical Equipment Repairer
66	Cable Systems Installer-Maintainer
67	General Construction Equipment Operator
68	Concrete and Asphalt Equipment Operator
69	Quartermaster & Chemical Equipment Repairer
70	Power-Generation Equipment Repairer
71	Special Purpose Equipment Repairer
72	Wheel Vehicle Repairer
73	Air Defense Command, Control, Communications, Computers & Intelligence Tactical Operations Center Enhanced Operator Maintainer
74	Visual Information Equipment Operator-Maintainer
76	Air Traffic Control Equipment Repairer
77	Self-Propelled Field Artillery Turret Mechanic
81	Radio Operator-Maintainer
83	Motor Transport Operator
84	Field Artillery Meteorological Crewmember
86	OH-58D Helicopter Repairer
87	Prime Power Production Specialist
88	Avionic Radar Repairer
89	Tactical Unmanned Aerial Vehicle (TUAV) Operator
91	AVENGER Crewmember
94	Technical Engineering Specialist
95	Watercraft Operator
97	Aircraft Powerplant Repairer
101	Cavalry Scout
103	Watercraft Engineer
106	OH-58D Armament/Electrical/Avionics Systems Repairer
107	Automatic Test Equipment Operator & Maintainer
109	Metal Worker
111	Telecommunications Operator-Maintainer
114	Radio & Communications Security (COMSEC) Repairer
115	Test, Measurement, and Diagnostic Equipment Maintenance Support Specialist
117	Field Artillery Surveyor
118	Machinist
119	Carpentry & Masonry Specialist
121	Bradley Linebacker Crewmember
124	AH-64 Armament/Electrical Systems Repairer
125	Topographic Analyst
126	Aircraft Electrician
129	Fuel & Electrical Systems Repairer
132	Aircraft Structural Repairer
133	Signal Support Systems Specialist
134	Wire Systems Equipment Repairer
136	Lithographer

139	Laundry & Textile Specialist
140	Track Vehicle Repairer
142	Heavy Construction Equipment Operator
144	CH-47 (or perhaps medium) Helicopter Repairer
146	Radiology Specialist
149	AH-64D Armament/Electrical/Avionics Systems Repairer
150	Diver
151	Construction Equipment Repairer
152	UH-1 Helicopter Repairer
153	Chemical Operations Specialist
154	Ammunitions Specialist
155	Armament Repairer
157	Special Electronic Devices Repairer
158	Field Artillery Firefinder Radar Operator
162	Transmission & Distribution Specialist (Reserve Components)
163	Observations/Scout Helicopter Repairer
164	AH-1 Attack Helicopter Repairer
165	Man Portable Air Defense System (MANPADS) Crewmember (Reserve)
166	CHAPARRAL & REDEYE Repairer
167	Land Combat Support System Test Specialist
168	Turbine Engine Driven Generator Repairer
169	Quarrying Specialist
170	Utility Airplane Repairer (Reserve Components)
171	Aircraft Armament/Missile Systems Repairer
172	Railway Equipment Repairer (Reserve Components)
173	Railway Section Repairer (Reserve Components)
174	Railway Operations Crewmember (Reserve Components)

Note. Options for evaluation of actual performance are hands on demonstration, evaluation of final work products, embedded on-the-job monitoring, or historical records.

Cluster 5:
Low/Medium Fidelity Interactive Simulation and Multiple-Choice Questions

ID Number	MOS Title
27	Field Artillery Tactical Data Systems Specialist
31	Common Ground Station (CGS) Operator
32	Electronic Intelligence Interceptor/Analyst
37	Intelligence Analyst

Cluster 6: High Fidelity Interactive Simulation and Multiple-Choice Questions

ID Number	MOS Title
51	Air Traffic Control Operator

Cluster 7: Multiple-Choice Questions, Situational Judgment Test, and Evaluation of Actual Job Performance

ID Number	MOS Title
20	Healthcare Specialist
49	Military Police
85	Criminal Investigations Special Agent
90	Chaplain Assistant
120	Mental Health Specialist
130	Firefighter
147	Corrections Specialist

Note. Options for evaluation of actual performance are hands on demonstration, evaluation of final work products, embedded on-the-job monitoring, or historical records.

Appendix E

Materials for Performing a Preliminary Job Analysis

Instructions for Job Analysts: Completing the Preliminary Job Analysis Form

Goal

The primary goal is to collect sufficient job analysis information about selected MOS to determine whether each of these MOS has been assigned to the correct MOS/measurement approach job cluster. Confirmation of this assignment will allow us to (a) make a final determination of the types of assessments to develop for each MOS and (b) design the detailed job analysis approach for each MOS so that it will be efficient and support the development of the necessary assessments.

Your Task

Your task is to collect the information necessary to achieve this goal by (a) reviewing existing information (e.g., Soldier manuals and task lists), (b) conducting interviews and direct observations of work, and (c) completing the *Preliminary Job Analysis Form* for your assigned MOS.

Step 1: Review Preliminary Job Analysis Support Materials

Phase 1 Report – This document will help you understand how the preliminary job analysis fits in the context of the broader project.

Example Preliminary Job Analysis Form – This is an example of the form you will eventually complete for your assigned MOS.

Taxonomy of Potential Major Work Activities – This is a taxonomy of work activities that will help you to derive relevant details from your review of existing information about your MOS.

MOS Characteristics – This is a taxonomy of MOS characteristics that can affect decisions about the types of measures to use for assessing job performance in a particular MOS.

Step 2: Review Existing MOS Information

Review existing information about your MOS. Likely documents include:

- Skill Level 1 Soldier Manuals for the MOS. These can be very detailed documents. Try not to be overwhelmed by the detail; remember you are aiming for a level of detail similar to that illustrated in the example form.
- A task list from the Army's current Army Occupational Survey program. Be careful; they vary considerably quality for our purposes and how up-to-date they are.
- Manuals for particular procedures and/or equipment. This can be valuable and informative, but be careful not to get too far into the weeds.

Notes: Find out how current your materials are and whether some more recent versions are about to be published. Also, make sure to keep and file copies of these documents because more careful analysis of them might be important during the detailed job analysis and measure development efforts.

Step 3: Complete the First Draft of the Preliminary Job Analysis Form

Review of existing materials should provide enough information for a first draft of this form.

- A. Based on your review of existing materials select the 8 to 12 broad activities from the *Taxonomy of Potential Major Work Activities* that you think are most important to successful performance in this MOS. Record the titles of these activities in your form. Under each activity include the best two to five examples you can come up with of MOS-specific activities that illustrate why this broad activity is important for this MOS (see example form).
- B. Next, evaluate the MOS on each characteristic in the list of *MOS Characteristics*. For each of the *Determinants of Performance* indicate whether the MOS appears to require a high, medium, or low level of that determinant relative to other determinants. (Note: This may be a difficult judgment to make, but do your best. There will be opportunities for review and revision.). For those determinants that you judge to be required at a medium or high level, provide the best two to five examples you can find in the materials of MOS-specific knowledges or skills that illustrate why this general knowledge or skill area is important for this MOS. The example form indicates that 11B Infantryman requires a **High** level of the *Procedural Knowledge & Skill (PK&S) Manipulating Objects* and shows the following illustrative examples:

- PK&S Manipulating Objects [High]
 - Physical Skills
 - Skill in assembling and disassembling a personal weapon
 - Skill in navigating with a ground position Location System (GPS) device
 - Skill in administering basic first aid
 - Psychomotor Skills
 - Skill in firing a personal weapon at a moving target
 - Skill in zeroing a weapon

- C. The next part of the *MOS Characteristics* section of the form is titled *Cognitive Complexity*. Here you are asked to make judgments about the MOS's standing on different characteristics that can result in it demanding more or less cognitive capacity. They include the degree of Information Intensity, Judgment/Problem Solving, and Systems Thinking (see *MOS Characteristics*). For each, indicate the extent to which you think the characteristic is important enough to performance at Skill Level 1 that it needs to be assessed by the job performances measure(s) we will develop for the MOS. Include a brief narrative supporting your judgment (see example form).

- D. *Work Context* comes after *Cognitive Complexity*. For the first characteristic, Method of Getting Information/Communicating, just record your best judgment about importance of each of the four methods of communication to Skill Level 1 performance in this MOS. For *Work Context* characteristics 2 through 8, indicate the extent to which you think the characteristic is important enough to performance at Skill Level 1 that it needs to be assessed by the job performances measures. Include a brief narrative supporting your judgment (see example form).
- E. The next section is *Major Tools, Equipment, and Systems*. The idea here is to list the tools, equipment and/or systems that you think are important to the MOS. Examples include personal weapons, navigation equipment, and computer systems for communication or operating crew served weapons as well as more obvious civilian equivalents (e.g., large truck for transporting supplies, construction tools, and human resource management software). An important caution to keep in mind is that lists of tools and equipment for many MOS are over inclusive. That is, they include many items that are used by only a minority of the Skill Level 1 Soldiers in a particular MOS. In fact, the tools and equipment used in some MOS are so assignment/unit specific that it is only a small set of items that are used by all or even most of the individuals in an MOS. Even at this early stage, do your best to stick with only the tools, equipment, and systems that are most relevant. A major goal in latter interviews and reviews will be to identify the items that are broadly used across the MOS and/or that need to be tracked in the performance measures (i.e., tools, equipment, and systems that are very important to some in the MOS, but not relevant to others). The example form includes examples for 11B Infantryman.
- F. The final section of this form is *Practical Considerations*. Here you should include additional information that you think is relevant to developing performance measures for this MOS. At the least, you should include a brief narrative regarding the likely future of the MOS and indicate your best estimate of the number of Skill Level 1 Soldiers currently in the MOS. For example, some MOS are in the process of being collapsed into others or are so small that it might be not very beneficial for them to be part of the initial focus of this effort (see example form).

Step 4: Prepare for and Conduct Subject Matter Expert (SME) Interview and Job Observation

The objective of this step is to correct, supplement, add to, and refine your first draft of the *Preliminary Job Analysis Form*.

- A. Have the first draft reviewed by at least two members of the project staff who are familiar with the goals of the preliminary job analysis. Also, to the extent possible select staff members who are familiar with the MOS. Ask them to (a) make edits based on their knowledge of the MOS and/or the Army in general and (b) suggest questions and clarifications to focus on during the interview. Additionally, you and the reviewer should ask yourselves whether there are any outstanding issues that could easily be resolved with another source of information (e.g., written material or an SME we can call) before the formal interview. Make any necessary revisions at this time.

B. Develop an interview/job observation procedure tailored to your MOS. The first part of the interview should include a standard and very short briefing describing the goals, methods, and likely outcomes of this effort. Next, you should think about how to explain to the SME(s) the process you used to develop the first draft of the form and ask them to comment on each part. Use the form itself to structure the interview. For example, explain to the SME(s) that you selected the 8 to 12 broad activities that you think are most important to successful performance in this MOS. Ask them to comment on/revise your selections and give you feedback on your illustrative MOS-specific activities. Use this process to develop a procedure for reviewing and revising the rest of the form. Here are some likely questions:

- Are there any other relevant existing materials that we should review?
 - Is this activity, determinant, or tool important for everyone in this MOS? For what units/assignments is it most important and for what proportion of the existing Skill Level 1 Soldiers do you think it is relevant?
 - Did I select the correct broad activities and do I have the best MOS-specific activities as examples?
 - Did I judge the importance of each determinant correctly and did I pick the best example knowledges or skills?
 - Is this item important for Skill Level 1 Soldiers or does it apply only to higher skill levels?
 - Are likely changes in this MOS going to make this item more or less important in the future?
 - Is this item important enough to make sure it is included in an assessment of performance for this MOS when you consider that you can't test everything? Here are a few example strategies for this question:
 - When Soldiers make a mistake in this area is it general because (a) of a lack of knowledge about what to do, (b) they didn't get enough practice on this task, or (c) they just weren't motivated to get it right?
 - When you consider all the things that a fully proficient Skill Level 1 Soldier should be able to do would you give this item a high, medium, or low priority for including in a measure of performance?
 - Does competence on this item regularly distinguish good performers from poor performers in this MOS?
 - During the preliminary job analysis, job observation should be reserved for only those occasions when it seems necessary to resolve a question regarding an element of information on the form. This won't happen often.
- C. After conducting the interview/job observation, prepare notes describing all the relevant information collected and develop and finalize the second draft of the *Preliminary Job Analysis Form*.

Step 5: Prepare Final Version of the Preliminary Job Analysis Form

Have the second draft reviewed by at least three members of the project staff. Make sure that at least one of them was a reviewer of the first draft. Finally, prepare the final version of the Preliminary Job Analysis Form for your MOS.

Example Preliminary Job Analysis Form

11B Infantryman (Skill Level 1)

Major MOS-Specific Activities

- Performing General Physical Activities
 - Enter buildings during an urban operation
 - Install pickets, barbed wire, and concertina
- Handling and Moving Objects
 - Construct a field-expedient antenna
 - Destroy supplies and equipment
- Controlling Machines and Processes
 - Zero a weapon
 - Engage targets with a weapon
- Communicating with Supervisors, Peers, or Subordinates
 - Use visual signaling techniques to move as a member of a fire team
 - Report position to supervisor using radio
-
-
-

MOS Characteristics

Determinants of Performance

- Declarative Knowledge [Medium]
 - Knowledge of steps for zeroing a weapon
 - Knowledge of procedures for employing aiming devices (e.g., night and thermal sites & aiming lights)
 - Knowledge of movement techniques during urban operations
- PK&S Manipulating Objects [High]
 - Physical Skills
 - Skill in assembling and disassembling a personal weapon
 - Skill in navigating with a ground position Location System (GPS) device
 - Skill in administering basic first aid
 - Psychomotor Skills
 - Skill in firing a personal weapon at a moving target
 - Skill in zeroing a weapon
-
-
-

Cognitive Complexity

- Information Intensity [Medium]
 - Given the hierarchical nature of infantry fire teams and squads, the amount of information an 11B needs to process at once is generally not overwhelming compared to other MOS.
- Judgment/Problem Solving [Low]
 - Despite the fact that 11Bs may need to make many decisions, at Skill Level 1 most situations requiring a complex decision are addressed by supervisors or covered by an order, rule, or regulation.
-
-
-

Work Context

- Method of Getting Information/Communicating
 - Face-to-face [High]
 - Radio, telephone or other audio device [Medium]
 - Manuals or other non-computerized text [Low]
 - Computer/Visual Display [Currently Low/Likely to Increase in Future]
-
-
-
- Time Pressure/Decision Speed [High]
 - Given the nature of operating as a member of a fire team in combat and training situations the necessity to make decisions quickly is high.
-
-
-

Major Tools, Equipment, and Systems

- Individual weapons (i.e., M9, M16 Series, M203, M240 Series, M257, MK19, M249, M60, .50 M2 Machine Gun, M242, M4)
- Aiming Devices
 - Night Sites
 - Thermal Sites
 - Aiming Lights
- Radios
- Compass
- Portable Ground Position Location System (GPS) device
-
-
-

Practical Considerations

- This MOS is likely to remain in its current (or a very similar form) for the foreseeable future.
- This MOS is very populous. It has sufficient numbers that (a) it will be relatively straightforward to gain access to a sufficient number of subject matter experts and Soldiers to develop measures and (b) an effective measure of job performance for 11Bs would affect a substantial portion of the Army's first tour population.

Taxonomy of Potential Major Work Activities
(Adapted From O*NET Generalized Work Activities)

1. **Getting Information** – Observing, receiving, and otherwise obtaining information from relevant sources.
2. **Identifying Objects, Actions, and Events** – Identifying information by categorizing, estimating, recognizing differences or similarities, and detecting changes in circumstances or events.
3. **Monitoring Processes, Materials, or Surroundings** – Monitoring and reviewing information from materials, events, or the environment, to detect or assess problems.
4. **Inspecting Equipment, Structures, or Materials** – Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.
5. **Estimating the Quantifiable Characteristics of Products, Events, or Information** – Estimating sizes, distances, and quantities; or determining time, resources, or materials needed to perform a work activity.
6. **Judging the Qualities of Objects, Services, or People** – Assessing the value, importance, or quality of things or people.
7. **Evaluating Information to Determine Compliance with Standards** – Using relevant information and individual judgment to determine whether events or processes comply with regulations, policies or procedures.
8. **Processing Information** – Compiling, coding, categorizing, calculating, tabulating, auditing, or verifying information or data.
9. **Analyzing Data or Information** – Identifying the underlying principles, reasons, or facts of information by breaking down information or data into separate parts.
10. **Making Decisions and Solving Problems** – Analyzing information and evaluating results to choose the best solution and solve problems in situations where judgment is required (i.e., when the problem cannot be straightforwardly resolved by applying a specific knowledge[s] or skill[s]).
11. **Thinking Creatively** – Developing, designing, or creating new applications, ideas, relationships, systems, or products, including artistic contributions.
12. **Updating and Using Relevant Knowledge** – Keeping up-to-date technically and applying new knowledge to your job.
13. **Scheduling Activities** – Scheduling events, programs, and activities.
14. **Organizing, Planning, and Prioritizing Work** – Developing specific goals and plans to prioritize, organize, and accomplish your work.
15. **Performing General Physical Activities** – Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials.
16. **Handling and Moving Objects** – Using hands and arms in handling, installing, positioning, and moving materials, and manipulating things.
17. **Controlling Machines and Processes** – Using either control mechanisms or direct physical activity to operate machines or processes (not including computers or vehicles).
18. **Working with Computers** – Using computers, computer systems, or other computer based technology (including hardware and software) to program, write software, set up functions, enter data, or process information.
19. **Operating Vehicles, Mechanized Devices, or Equipment** – Running, maneuvering, navigating, or driving vehicles or mechanized equipment, such as forklifts, passenger vehicles, infantry fighting vehicles, tanks, or water craft.
20. **Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment** – Providing documentation, detailed instructions, drawings, or specifications to tell others about how devices,

parts, equipment, or structures are to be fabricated, constructed, assembled, modified, maintained, or used.

21. **Repairing and Maintaining Mechanical Equipment** – Servicing, repairing, adjusting, and testing machines, devices, moving parts, and equipment that operate primarily on the basis of mechanical (not electronic) principles.
22. **Repairing and Maintaining Electronic Equipment** – Servicing, repairing, calibrating, regulating, fine-tuning, or testing machines, devices, and equipment that operate primarily on the basis of electrical or electronic (not mechanical) principles.
23. **Documenting/Recording Information** – Entering, transcribing, recording, storing, or maintaining information in written or electronic/magnetic form.
24. **Interpreting the Meaning of Information for Others** – Translating or explaining what information means and how it can be used.
25. **Communicating with Supervisors, Peers, or Subordinates** – Providing information to supervisors, coworkers, and subordinates by telephone, in written form, e-mail (or other electronic devices), or in person.
26. **Communicating with People Outside the Organization** – Communicating with people outside the organization, representing the organization to the public, other parts of the military or government, and/or indigenous personnel. The information can be exchanged in person, in writing, or by telephone or e-mail (or other electronic devices).
27. **Establishing and Maintaining Interpersonal Relationships** – Developing constructive and cooperative working relationships with others, and maintaining them over time.
28. **Assisting and Caring for Others** – Providing personal assistance, medical attention, emotional support, or other personal care to others such as coworkers, indigenous personnel, patients, or clients.
29. **Influencing Others** – Convincing others to change their minds or actions.
30. **Resolving Conflicts and Negotiating with Others** – Handling complaints, settling disputes, and resolving grievances and conflicts, or otherwise negotiating with others.
31. **Working Directly with Non-Military Personnel** – Dealing directly with the public. This includes serving or directing military dependents, other U.S. citizens, foreign military personnel, prisoners of war, and foreign indigenous civilians.
32. **Contributing to and Supporting Teams** – Providing assistance and support to team members and helping the team remain focused on its goals.
33. **Performing Administrative Activities** – Performing day-to-day administrative tasks such as maintaining information files and processing paperwork.
34. **Monitoring and Controlling Resources** - Monitoring and controlling the expenditure of resources.

Definitions of MOS Characteristics

Determinants of Performance

1. Declarative Knowledge – knowledge of facts and things; including lists of steps in a procedure (i.e., knowing what to do).
Note: In very practical terms this means knowledge (including some knowledge application) that could be assessed with a multiple-choice test, including test items with graphical, audio, and/or visual stems and/or response options.
2. Procedural Knowledge & Skill (PK&S)/Manipulating Objects – (e.g., assembling a weapon, operating a cash-register, aiming a large weapon)
 - Physical Skills – performing activities that require strength, endurance, flexibility, balance, and/or coordination
 - Psychomotor Skills – gross or fine manipulation of objects requiring precision and/or control (e.g., rate control, response orientation, reaction time, speed of movement)

Note: The following definition applies to all of the PK& S characteristics. Procedural Knowledge & Skill – the successful combination of “knowing what to do” with “knowing how to do it;” this is especially prominent when mastery depends on practice (e.g., word processing or interacting with customers). Test items/scenarios addressing procedural knowledge focus on requiring incumbents to simulate doing part of their work.
3. PK&S/Interacting with others – effective interaction with others (e.g., team members, supervisors, civilians, indigenous military personnel)
 - Interpersonal Skills
 - Listening
 - Speaking
4. PK&S/Using information resources – Finding information in a manuals, data bases, or on a intra/internet
5. PK&S/Reading
6. PK&S/Writing [Reading and writing refer specifically to activities required by the MOS, not to these skills in the general context.]

Cognitive Complexity

1. Information Intensity – complex decision-making and/or processing a lot of information at once.
2. Judgment/Problem Solving – situations where the Soldier needs to exercise judgment regarding problems that are not easily addressed by a specific knowledge(s) or skill(s). That is, situations in which judgment might be important, even for Skill Level 1 Soldiers: (a) there is a regulation, rule, or procedure, but recognizing that it is relevant or necessary to follow is

difficult for some; (b) the manuals don't cover this (a lot of interpersonal, team, and leadership stuff might fall in this category); and (c) different, potentially contradictory, policies seem to be relevant to the situation.

3. Systems Thinking – understanding a “system” with a number of interrelated elements that affect each other. Examples of jobs high on this characteristic include, Civilian Air Traffic Controller, Water Treatment Specialist, and Dispatcher. An MOS completely lacking in this characteristic would be one in which very few of its tasks are dependent on each other (i.e., a number of discrete task where performance on one tasks is not affected by performance on the others).

Work Context

1. Method of Getting Information and Communicating with Others – How does the soldier get the information necessary to perform?
 - Computer/Visual Display
 - Radio, telephone, or other audio device
 - Manuals, memos, or other non-computerized text
 - Face-to-face personal communication
2. Level of Social Interaction – amount and complexity of interpersonal contact with others
3. Level of Interpersonal Conflict/Strained Interaction – extent to which the MOS requires or results in conflict with others or dealing with individuals who are angry or hostile
4. Exposure to Extreme Environmental Conditions or Hazards – e.g., temperature, noise, light, air contaminants, CBRN hazards, and/or other situations requiring safety equipment, clothing, or procedures
5. Level of Vigilance – extent to which the MOS requires the Soldier to maintain attention or alertness, either for events or circumstances that do not occur often or for those that are subject to continual change
6. Time pressure/decision speed – performing work or making decisions quickly
7. Attention to Detail – extent to which the MOS requires thoroughness to make sure nothing is left undone or that all steps are taken in the proper order
8. Distractions and Interruptions – extent to which the Soldier can expect to distractions and/or interruptions and the extent to which these are under the Soldiers control

Major Tools, Equipment, and Systems

A list of the major tools, pieces of equipment, and systems that are used by all or most of the Skill Level 1 Soldiers in this MOS.

Appendix F

Assessment Design Guide Template



ASSESSMENT DESIGN GUIDE TEMPLATE

<INSERT MOS TITLE>

SKILL LEVEL <1 OR 2>

SBIR, A2-1222, PHASE II

THE U.S. ARMY RESEARCH INSTITUTE FOR THE
BEHAVIORAL AND SOCIAL SCIENCES

**<INSERT DATE>
<INSERT REVISION NUMBER>**

Section I – Background

Job title (Skill level):

<Insert job title and, in parentheses, targeted skill level i.e., 1 or 2>

MOS Description:

<Insert brief description of MOS.>

Start with summary of Major Duties. Follow by description of major tasks/activities. Description can be taken from the set of descriptions of Army MOS derived from U.S. Army Pamphlet 611-21 (Department of the Army, 1999) and used in the Phase I SBIR effort.

Assessment Strategy

Describe the measurement method (or methods) to be used. Select from the list shown below. Provide any information available about desired length of the assessment (e.g., number of test items, time to complete). Indicate means by which the measure will be administered and scored.

Assessment Method Options	
Computer-Based Testing	
Independent multiple-choice items	
Multiple-choice items presented as part of job scenarios	
Low to medium fidelity interactive simulation	
High fidelity interactive simulation	
Situational judgment test items	
Actual Job Performance	
Hands on demonstration	
Historical records	
Embedded on-the-job monitoring	
Evaluation of final work products	

Section II – Assessment Overview

Using the heading shown below, provide an overview of the design of the measure and how it will function. Describe the elements of the assessment and how they will function. Indicate how the user will interact with these elements. As appropriate, prepare a structure diagram for computer-based tests that clarify the possible paths a user can take to proceed through the testing activities. Describe actions the user takes to physically navigate from screen to screen. Describe how the user will be instructed in the use of the assessment.

Assessment Elements and Functionality

Structure

Navigation

Instructions

Section III – Deliverables

List and describe all project deliverables (draft and final). Indicate number of copies of each to be delivered. Indicate which products are to be delivered in hard copy and which in electronic form. For software, indicate what source code and what executables will be provided. Indicate what software documentation will be provided.

Section IV – System Requirements

Indicate all software and hardware requirements that will be needed to operate the measures.

PC Computer System (check all that apply)

486
 Pentium
 Pentium 2
 Other _____

Macintosh compatible Yes _____ No _____

CPU

Minimum recommended processor speed _____

Memory (indicate amounts)

Minimum RAM _____ Recommended _____
Minimum hard drive space _____ Recommended _____

Operating System

Windows 3.1 Yes _____ No _____
Windows 95 Yes _____ No _____
Windows 98 Yes _____ No _____
Windows 2000 Yes _____ No _____
Windows XP Yes _____ No _____
MAC O/S Yes _____ No _____ If Yes, then version _____
UNIX Yes _____ No _____
Windows NT Workstation Yes _____ No _____

Multimedia Components

Sound card with speakers Yes _____ No _____
Sound card type (e.g., Sound Blaster compatible) _____
CD-ROM: Yes _____ No _____
Other _____

Software Plug-ins

Flash Player Yes _____ No _____

Other (list) : _____

Communications

Network/Internet Yes _____ No _____

Recommended Baud _____

Monitor

Size of screen (e.g., 15 inch, 17 inch, 19 inch) _____

Recommended resolution (e.g., 800 by 600 or 1024 by 768) _____

Number of colors (e.g., 256) _____

Browser

Netscape Yes _____ No _____ (if yes then minimum version _____)

Explorer Yes _____ No _____ (if yes then minimum version _____)

Other _____

Other (e.g., peripherals): _____**Section V – Project Structure and Management**

Provide a breakdown of the project into major tasks and subtasks. For major tasks, select from the list below:

- Preliminary Job Analysis
- Formal Job Analysis
- Assessment Design
- Measure Development
- Pilot Testing
- Final Revisions
- Report Writing
- Software Documentation
- Project Management Activities

Generate subtasks as needed. Enter the structure into the JPS automated time keeping system (HumRRO will use a comparable paper based system). This information will be used to manage the project and, at the conclusion of the project, as metrics to help identify/evaluate process improvement efforts.

Select project roles (e.g., project manager, computer programmer, writer/editor, instructional designer) from the automated time keeping system. Associate individual employees to these roles and provide permissions for them to charge to appropriate tasks/subtasks. Coordinate with HumRRO to ensure we can obtain comparable data.

The project manager is responsible for preparing a project budget/planning spreadsheet. This person must update the budget on a monthly basis. This person must also update the company master JPS coverage spreadsheet at the start of each month so JPS management can use this tool to help ensure all projects have sufficient resources.

Section VI – Project Schedule

<insert project schedule here>

Describe any significant risks you foresee in meeting the schedule (e.g., delayed start date, lack of SME support, use of new programming tools) and actions that need to happen to address these risks. Complete a table such as the one below to indicate dates when client is to receive materials for review and when the reviews must be completed.

Client Reviews		
Item	Dates (When Provided When to Be Returned)	Comments

Complete a table such as the one below to clarify what SMEs will be required and when they be needed.

SME Requirements		
Date	SMEs	Purpose

Section VII – Communications

Formal

JPS will submit monthly status reports according to the requirements stated in our contract with the U.S. Army. The report will describe work completed during the reporting period, work to be completed during the next period, and any issues.

Informal

JPS will communicate by phone and email with the client on a routine basis, as needed, throughout the life of the project.

Section VIII – Page Designs

General Considerations

Obtain from sponsor any Army or Army proponent requirements for items on screens (e.g., logos, symbols, colors, headers, footers). Describe the nature of any photos, videos, graphics, etc. you anticipate adding to screens. Determine who can provide such information and what releases may be needed before they can be used.

Depending on the design of the assessment, indicate the main color scheme to be used (see example shown below). Minimum palette colors typically consist of a primary color, an accent color, and a secondary color. The primary and secondary web-safe colors should provide an easy-to-view contrast against the interface background. For web delivered products select accent colors that are web safe.



Sample Screen Pages

Use this section to provide sample screen pages. For any computer-based test you will likely need to provide, at a minimum, the following samples:

- Splash page
- Registration page
- Instructions page
- Simulated equipment, tools, job aids
- Other items of job information
- Test items
- End-of-test page

Section IX – Assessment Content and Sequence

Typically one of the early steps in the design phase is to produce scripts and/or storyboards of the content. These items indicate the sequence of events, the text to be displayed on the screen, interactivity, and any branching.

For the design guide, indicate how the content and sequence will be portrayed (e.g., MS Word document listing individual test items, scripts, storyboards). Provide as much information as possible at this stage regarding the number, length, detail required in these documents. If possible provide a template for these documents.

Section X – Quality Control

Indicate the timing when formal quality control checks will be made on products. Indicate which checks will be conducted by members of the JPS team and by SMEs. Describe the goals of the pilot test and how we will determine information we need to ensure the quality of the measures.

Section XI – Process Improvement

One of our goals in producing any performance assessment is make demonstrated progress in improving the efficiency of the process for the next assessment. There are two types of process improvement efforts. One is designed to reduce time/costs. The other is to maintain or improve quality. In this section, indicate the strategy for achieve improvements in both areas.

Indicate what new tools, procedures, or templates will be developed to make the process we follow more standardized and streamlined. Select one or more test development steps for which we can reduce the time and effort required without a reduction in the quality of the output. Use historical data to set targets for a reduction in time/costs. For each process improvement initiative, determine the quantitative and qualitative metrics that will be tracked to support these efforts.

Section XII – Assumptions

Summarize any key assumptions you are making regarding this project.

Appendix G

Assessment of Realism in Computer-Based Tests

Part 1: Evaluation of the Design and Operation of the Assessment

Instructions: Individuals who complete Part 1 should have in-depth knowledge of the job. They should also have completed the assessment or spent sufficient time observing the test to fully understand its content and operation.

Physical Fidelity

1. Stimuli Characteristics

Rate the extent to which test information is presented in a manner equivalent to how the same information is provided on the job. Consider if the mode (i.e., text, pictures, auditory, tactile) is the same. Then consider how closely the presentation of information between the job and test match.

- Low (For almost all of the important stimuli the modes do not even match)
- Moderate (The modes match but the stimuli are only somewhat similar)
- High (For almost all of the important stimuli there is a very high match)

2. Response Characteristics

Rate the extent to which the assessment provides response options equivalent to those available on the job. Consider if the method for responding is equivalent (i.e., writing, typing, speaking, psychomotor action). Then consider how closely the test responses truly mimic the same responses on the job.

- Low (The method of responses do not match)
- Moderate (The methods match but the manner of making responses are different)
- High (Responding is virtually identical between the assessment and the job)

3. Contextual Factors

Consider the extent to which such factors as background noise, feeling of motion, light conditions, distractions, sounds made by equipment one uses, and other significant contextual factors are present. Then consider how closely these factors are duplicated by the assessment.

- Low (No contextual factors are present, or they bear little resemblance to the job)
- Moderate (Contextual factors are present but only of moderate similarity)
- High (Factors are present and of high fidelity)

Psychological Fidelity

4. Relevance of the Content

To what extent do the tasks, challenges, situations, reflect important components of job performance?

- Low (Test content reflects events that are unimportant or unlikely to occur)
- Moderate (Content reflects activities of moderate importance)
- High (Content focuses completely on important aspects of the job)

5. Quality of the Test Content

To what extent is the content well constructed? To what extent is it accurate, sequenced appropriately, and sufficiently complete to be true to the job?

- Low (Content is poorly constructed)
- Moderate (Content is somewhat well constructed)
- High (Content is well constructed)

Additional Characteristics that Can Influence Realism

6. Timing and Pace

To what extent is the timing and pacing of the test appropriate? The pace should not be slower than one would expect to find on the job. It should not be so fast that it creates a unrealistic speeded test.

- Low (Pacing is much too slow or fast)
- Moderate (Pacing is somewhat too slow or fast)
- High (Pacing is highly appropriate)

7. Span of Events

Indicate the extent to which the events covered in the test span a significant portion of the job (e.g., large tasks or activities).

- Low (The test measures a number of unrelated actions)
- Moderate (The test contains events that are somewhat well related and sequenced)
- High (The test effectively integrates events across large tasks and job activities)

Features Necessary to Support Test Validity

8. Representativeness

To what degree does the content reflect a representative sample of the important behaviors in the job?

- Low (The test focuses on just a small portion of the important tasks)
- Moderate (The test focuses on about half of the important tasks in the job)
- High (The test samples from all important tasks in the job)

9. Meaningfulness of Scores

Evaluate the quality of the logic used in scoring test performance, combining scores, and setting a level of acceptable performance.

- Low (No convincing rationale exists to explain the scoring system)
- Moderate (Some logic exists)
- High (The rationale is clear and convincing)

10. Standardization

To what extent is it likely the test will be administered in a standardized manner each time.

- Low (Testing depends heavily on the administrator. Any automation is unreliable)
- Moderate (The majority of the time the testing will be standardized)
- High (All testing is automated and reliable. The administrator's role is minimal)

Part 2: Reactions of the Test Taker

Instructions: Individuals who complete Part 2 should be Soldiers with substantial experience in the job. They should complete this section of the questionnaire upon finishing the test.

Please indicate the extent to which you disagree or agree with the following statements:

1. In taking this test, I made the same kinds of judgments that I make on the job.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

2. The information displayed in the test was very realistic.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

3. The test provides the same look and feel as the real job.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

4. This was an engaging test to take.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

5. The test provoked the same kind of emotional responses in me that I experience when performing these tasks on the job.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree